What's Next in Science?

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IT IS AN ALL TOO COMMON practice of scientific publicists and prognosticators to give free vent to their imaginations in a most unscientific way by picturing our descendants as flying through interplanetary space, after the manner of Buck Rogers—or operating a navy with a thimbleful of transmuting atoms—or banishing old age by administration of glandular extracts. No doubt many of the past triumphs of science were, relatively to the times, as spectacular and even more unexpected than these would be. However, scientific progress is not a great leap of imagination, but a steady process, like the advance of a great army; at times strategic positions are captured, as when the positive electron (positron) was discovered; at times there is a steady "mopping up" process all along the line, as when the systematic search for chemical isotopes followed the first discovery; at times there is retreat, as when a theory is proved untenable; at times a new powerful engine of this scientific war is invented, like the radio tube amplifier. While the scientific campaign is generally well planned in advance and directed toward certain main objectives, it also, on occasion, is opportunistic in that its center of activity may quickly be shifted by some new discovery or idea which discloses new territories to be conquered.

A better analogy to scientific progress is geographical exploration. Just as the discovery of the Great Lakes and the Ohio, Mississippi, and Missouri Rivers led to their use as avenues of colonization, so great scientific discoveries and theories are the channels for widespread advance of scientific knowledge. Similarly there are desert and mountain barriers in science where progress is slow because the oases and passes have not yet been discovered. But, as far as we can now see, there is no limit to the completeness with which man may expect to understand the materials, forces, and processes of nature. . . . . There are many divisions to this [science] army—the mathematicians, engineers, astronomers, chemists, physicists, botanists, psychologists, medical men, biologists, sociologists, and many others. . . . .

I have been asked to discuss the topic "What's Next in Science?" To answer this question properly, we need to consider where we are now and what has been our path in the past decades. Nowhere has this been more strikingly and comprehensively stated than in the preamble to a resolution adopted just a year ago by the American Association for the Advancement of Science and submitted to the President and the Congress of the United States, urging "that aggressive governmental support of scientific work is essential to any sound program of building for the future national welfare, and is essential if this country is to do its full part in the further advance of civilization and if it is to enjoy its proper share in the benefits of this advance."

The preamble to this resolution summarizes the importance and achievements of science in the following words:

"Development and application of science have been basic to the economic and social progress of nations, making possible such movements as universal education, abolition of child labor and slavery, emancipation of women, insurance and pensions, moderate hours of labor and great improvement in the standards of health, comfort, and satisfaction in living.

"Scientific developments have not only conferred general benefits, but in particular have been largely effective in leading to recovery from previous depressions—as the railroad industry following the depression of 1870, the electric industry following that of 1896 and the automobile industry following that of 1907.

"Scientific research is a productive investment proved by experience to yield a high rate of return, as illustrated by the saving of $2,000,000,000 per year from the Bessemer steel process and of over $1,000,000 per day from the modern incandescent lamp, and as illustrated also by the entire chemical, electrical, communication, transportation, and metallurgical industries and by the enormous employment in such industries.

"Progressive foreign nations have recognized the importance of maintaining their scientific strength at a high productive level and have provided for this maintenance by allocation of funds to support scientific work on a national scale.

"There now exists in America a situation demanding as never before an intelligent use of our national resources.

"There are manifold problems in health, safety, agriculture, better use of resources, development of new products, and processes whose social value and urgent need are unquestioned but whose solution is being seriously hampered by lack of funds for research, which have been greatly curtailed at this time when properly directed scientific work is more than ever needed.

"The great national planning program, which is now under consideration for the use of our physical resources of soil, minerals, and crops, will be seriously deficient unless it includes provisions for utilizing the scientific resources of the country for creative work."

What, in the light of this background, are some of the lines in which we may expect increased scientific activity in the near future? Let me suggest a few scientific problems of incalculable importance to the country.

First. Agricultural research in the past has led to greater yields of improved farm products. The great problem of agriculture today is to discover

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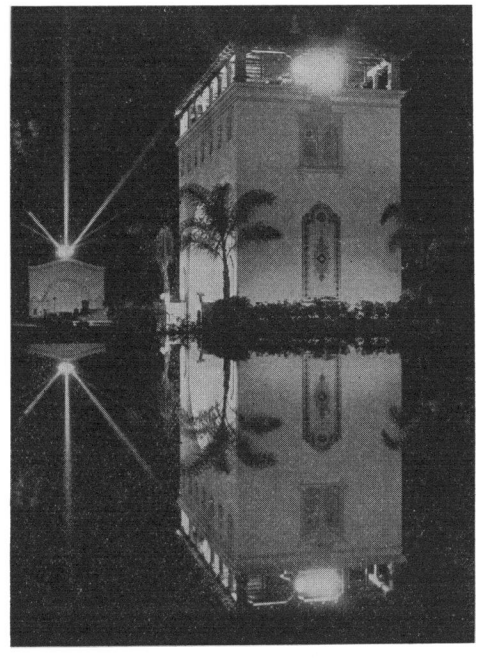
new uses for these products, uses that will create new social values or partially replace the consumption of our exhaustible natural resources. Silk from wood, rubber from weeds, and motor fuel (alcohol mixed with gasoline) from corn or potatoes are actual examples of what can be done. Experience justifies belief that, along such lines, science may create new demands for farm products which will provide a constructive and permanent solution of the agricultural problem. This would be an infinitely better solution than the present emergency expedient of paying huge sums to induce farmers to raise less—to plow under crops and slaughter stock, in order that the rest of us, who pay that bill, will also have to pay more for our food. I believe that no one, not even among its proponents, is enthusiastic about this destructive and temporary scheme to benefit agriculture. I call it temporary because there are already signs that it is doomed to failure in the rapidly mounting imports of food products from foreign countries—an inevitable situation which will not only kill the scheme but be a body blow at American agriculture itself. Cotton, meat, and wheat have been quick to respond to this invitation, by America, to foreign countries to seize not only America's foreign markets, but to invade the home markets as well. How much more satisfactory would be a positive solution, based on scientific developments, which will create new industrial demands for farm products, and thus stimulate instead of depress agricultural activity. Of all the expenditures authorized by the last Congress, the one which seems to me wisest was the appropriation of funds to the Department of Agriculture for use in research for developing new outlets for farm products. This is an encouraging sign, and presages important future scientific activity in this line—an activity which will probably be centered largely in chemistry and chemical engineering.

Second. I believe that a second line of increased activity in applied science will occur in industry—particularly in those industries which hitherto have depended largely on tariff protection, on monopolies, on exploitation of natural resources, on governmental subsidies or simply on momentum of past strength. These supports are temporary and precarious; sooner or later they fall before science, because no amount of artificial protection can permanently maintain an obsolete product, an inferior process, or a moribund organization against competitors which are based on scientifically improved products or methods. Furthermore, the general public is ill-served by industries that lean upon legislative favors rather than upon wide-awake technical policies for existence, and the public, when it knows the facts, is likely to take strenuous measures. We have splendid examples in the electrical, communication, chemical, and automotive industries, of industries that have met competition and continually have improved their service to the public through scientific research and the employment of technically trained men of highest caliber. And these industries are at the top of the list in prosperity. Contrast with these some other industries, which you can think of without my naming them, that have not built up their organizations with technically trained men, that depend more on lobbying than upon science for their prosperity, that are suffering from types of competition which they themselves might have developed and profited by, had they been alert to the opportunities offered by science. The contrast is striking. There are some signs that it has struck home even in boards of directors. I believe that the scientist and the engineer will be called upon as never before to lead all along the line in our industrial fields.

Third. In the medical field, we all know in a general way that there are great opportunities for scientific work. Few of us who are not close to this field realize how great the opportunities really are. For example, it is said that 20 per cent of all our state taxes go to the care of the mentally diseased. Think how great an investment, in money and in human happiness alike, it would be to pursue really actively those scientific leads which show any promise of prevention, alleviation, or cure. Tropical diseases are a tremendous drain, not only in the tropics but also in our healthier climates. It has been estimated that an alleviation of certain enervating diseases in the tropics would so raise the standards of living in these regions as to create an increased purchasing power that would well repay the probable cost of the medical research and practice necessary to improve the situation. Cancer, infantile paralysis, the common cold, influenza, and treatment by glandular extracts all suggest unsolved problems of medical science whose even partial solution would yield incalculable human as well as economic benefits.

Finally, the most important item of all is that the advancement of pure science should be fostered in every possible way. It is only as we learn about the materials, forces, and operations of the world in which we live that we can wisely adapt ourselves to life in it and use these materials and forces to our own advantage. Pure science seeks to gain this knowledge and applied science, or engineering, seeks to use it in desirable ways. These go hand in hand, and together their success epitomizes man's continual ascent to a richer, fuller, more satisfying life. . . . . .



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